EXHIBIT 12

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

CAPELLA PHOTONICS, INC.

Plaintiff,

v.

FUJITSU NETWORK COMMUNICATIONS, INC,

Defendants.

Case No. 2:20-cv-00076-JRG

JURY TRIAL DEMANDED

CAPELLA PHOTONICS, INC.

Plaintiff,

v.

INFINERA CORPORATION, TELLABS, INC., TELLABS OPERATIONS INC., CORIANT AMERICA INC., and CORIANT (USA) INC.,

Defendants.

Case No. 2:20-cv-00077-JRG

JURY TRIAL DEMANDED

EXPERT REPORT OF DR. ALEXANDER V. SERGIENKO

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I. Introduction

1. My name is Alexander V. Sergienko. Capella Photonics, Inc. has retained me as an expert witness. I have been asked to provide my expert opinion in connection with Capella Photonics, Inc. v. Fujitsu Network Communications, Inc., Case No. 2:20-CV-0076-JRG (E.D. Tex.) and Capella Photonics, Inc. v. Infinera Corporation, et al., Case No. 2:20-CV-0077-JRG (E.D. Tex.).

2. In this report, I set forth opinions in response to those filed by Dr. Michael S. Lebby, on March 15, 2021. My technical review, analysis, insights, and opinions are based on over 35 years of education, research, and experience, as well as my study of relevant materials.

3. I am being compensated for my work at a rate of $400.00 per hour. My compensation is not contingent upon and in no way affects the substance of my testimony.

II. Qualifications

4. I received my Ph.D. in Physics from Moscow State University in 1987 and my Master of Science Degree in Physics from Moscow State University in 1981.

5. I am currently a full professor at Boston University where I hold joint appointments in the Photonics Center, the Department of Electrical and Computer Engineering, and the Department of Physics. My expertise and research interests include optics, photonics, quantum physics, laser physics, nonlinear optics, and precise optical measurement in telecommunication and optical engineering.

6. I have experience and familiarity with the technical areas involved in this case. With over 35 years of research experience in the field of optics, I have studied and worked with optical components such as those at issue in this case. For example, during my tenure as a Director of the Quantum Communication and Measurement Laboratory at the Boston University Photonics Center, I developed quantum optical technologies for high-resolution evaluation of

reverts to blanket statements that it would have been obvious to a POSA to combine these references. Often, no specific elements in the references are pointed to, and one is left wondering what specific elements in the references should be combined with one another to obtain the claimed elements of the '905 and '906 patents. This level of analysis is insufficient to show obviousness because Dr. Lebby does not explain why it would have been obvious to a POSA to combine the references and how combining the references discloses the claimed limitations. As I will explain for each alleged prior art combination below, these flaws are systematic throughout Dr. Lebby's report.

A. U.S. Patent No. 6,798,941 ("Smith")

88. Dr. Lebby's obviousness analysis with respect to Smith is deficient in many respects. Dr. Lebby provides no analysis to show how Smith in combination with other references teaches the claimed limitations of the '905 and '906 patents. Dr. Lebby throughout his report provides nothing more than a mere conclusory statement, with no accompanying analysis, and often reverts to blanket statements that it would have been obvious to a POSA to combine these references. Often, no specific elements in the references are pointed to, and one is left wondering what specific elements in the references should be combined with one another to obtain the claimed elements of the '905 and '906 patents. This level of analysis is insufficient to show obviousness because Dr. Lebby does not explain why it would have been obvious to a POSA to combine the references and how combining the references discloses the claimed limitations. As I will explain, a POSA would not have found it obvious to combine Smith with the references Dr. Lebby points to.

1. Overview of Smith

89. Smith describes "optical switches used in multi-channel optical communications networks and having controlled transmissivity for different channels." Smith, 1:11-15. The optical switch including an array of mirrors for optical switching and power control. Smith, Abstract. But I have been told Smith is not prior art to the Capella claims.

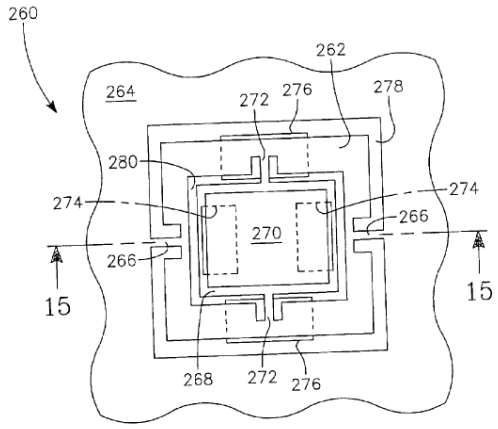
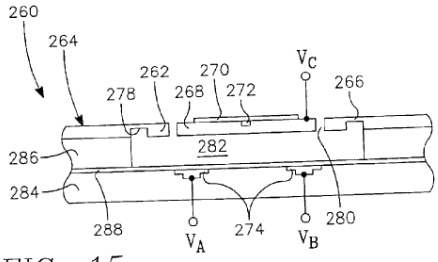
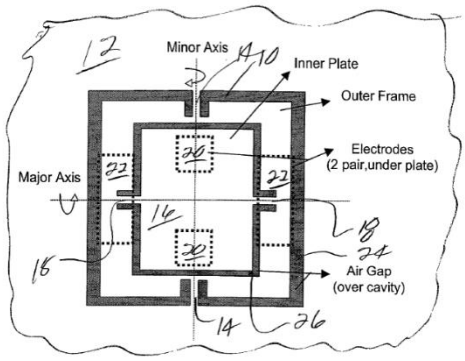
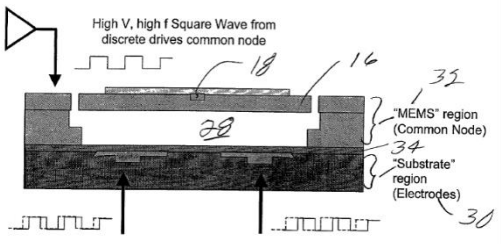
90. I have been told that for Smith to be prior art, the effective filing date from one of the two following provisional applications must be relied upon: (1)'285 Provisional Application and (2) '683 Provisional Application. I do not think either of these provisional applications can be relied upon for an earlier effective filing date. Smith is not entitled to benefit from the filing date of the '285 Provisional Application because Smith and the '285 Provisional Application do not share common inventorship. I have been told a non-provisional patent application can only claim priority to a provisional application with common inventorship.

91. Here, the inventive entities are entirely different. Smith (inventors David A. Smith, John E. Golub, and Fariborz Farhan), '285 Provisional Application (inventors Steven L. Garverick and Michael L. Nagy). Smith is therefore not entitled to benefit from the filing date of the '285 Provisional Application.

92. I have also been told Smith is also not entitled to benefit from the filing date of the '683 Provisional Application. Smith is not entitled to benefit from this filing date because the movable mirror disclosed in the '683 Provisional Application was not carried forward into the Smith patent. I have been told a patent is prior art as of its earliest effective filing date only for subject matter carried forward from the earliest application. *In re Lund,* 376 F.2d 982, 988 (C.C.P.A. 1967) ("the continuation-in-part application is entitled to the filing date of the parent application as to all subject matter carried forward into it from the parent application, whether for purposes of obtaining a patent or subsequently utilizing the patent disclosure as evidence to

defeat another's right to a patent."). And I have been told the Federal Circuit has extended this principle to patents claiming priority to provisional applications. *See In re Giacomini*, 612 F.3d 1380, 1383-84 (Fed. Cir. 2010); *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1381 (Fed. Cir. 2015) (citing *In re Wertheim*, 646 F.2d 527, 537 (C.C.P.A. 1981)).

93. Here, Smith's mirror structure is not entitled to the priority date of the '683 Provisional Application because the mirror disclosed in Smith was not carried forward from the '683 Provisional Application. Rather, the mirror structure was carried forward from the '285 Provisional Application, which Smith cannot claim benefit. As shown below, Smith's mirror is from the '285 Provisional Application —not the '683 Provisional Application. *See* CAP_0024162, CAP_0024177, and CAP_0024178.

Smith, FIGS. 14 and 15	'285 Provisional, FIGS. 1 and 2
 FIG. 14  FIG. 15	 Figure 1. Top view of electrostatic actuator with two axes and four driving electrodes.  Figure 2. Cross Sectional representation of symmetrical MEMS actuator showing common node and electrode arrangement.

Smith, 14:57-65	'285 Provisional
The cell includes a gimbal structure of an outer frame 262 twistably supported in a support structure 264 of the MEMS array through a first pair of torsion beams 266 extending along and twisting about a minor axis. The cell further includes a mirror plate 268 having a reflective surface 270 twistably supported on the outer frame 262 through a second pair of torsion beams 272 arranged along a major axis perpendicular to the minor axis and twisting thereabout.	It includes a gimbal structure of an outer frame 10 twistably supported in the support structure 12 of the MEMS array through a first pair of torsion bars 14 extending along and twisting about a minor axis and a mirror plate 16 having a reflective surface twistably supported by the outer frame 10 through a second pair of torsion bars 18 arranged along a major axis perpendicular to the minor axis and twisting thereabout.

94. The '683 Provisional Application refers to a mirror that allegedly could be rotated but there was no structure disclosed for that. In addition, the referenced mirror disclosure was

left behind; it was not carried forward into the Smith patent. Specifically, the '683 Provisional Application merely discloses "a mirror array with elements that can be rotated in an analog fashion about two orthogonal axes." *See* CAP_0024191.The '683 Provisional Application does not disclose the mirror structure in Smith. Smith used the structure from the '285 instead. Since Smith cannot rely on the provisional application where Smith's mirror originated (i.e., the '285 Provisional Application), Smith is not entitled to an earlier effective filing date, at least with respect to a two-axis mirror.

2. Global arguments for all claims

95. Smith was cited on the cover of the '905 and '906 patents. Smith was expressly used by the Examiner in a rejection during the '905 patent prosecution that was overcome and was cited in both the '905 and '906 patent prosecutions in an IDS during the prosecution, which was considered by the Examiner on June 6, 2019. *See* CAP_004618, CAP_0010912-CAP_0010919 and CAP_0014806-CAP_0014813. In addition, the File Histories of each from eight IPRs (IPR2014-01166, IPR2014-01276, IPR2015-00726, IPR2015-00727, IPR2015-00816, IPR2015-00894, IPR2015-01958, and IPR2015-01961)—all applying Smith—were included in an IDS during prosecution and signed by the Examiner on June 6, 2019. *See* CAP_0004794 and CAP_0014483.

96. The Board specifically stated in Institution Decisions of IPR 2015-00726 and IPR 2015-00727 that Smith does not teach "individually and continuously controllable in two dimensions to reflect its corresponding spectral channel to a selected one of said ports" and "dynamically and continuously controlling side beam-deflecting elements, thereby directing in two dimensions to direct said spectral channels into a plurality any selected one of said output ports and to control the power of the spectral channels coupled into said selected ports" without a

detailed explanation and analysis. *See* CAP_0002263-CAP_0002264 and CAP_0002274-CAP_0002275.

97. In view of the references cited in previous IPRs, and references cited on the cover of the '905 and '906 patents, the Examiner expressly stated that "the 'input collimator' and/or 'pass-through' collimator in combination with the other limitations of the claims is enough to place the claims in condition for allowance." *See* CAP_0004728.

98. The non-provisional application that led to Smith was filed on September 20, 2001—after the effective filing date of the '905 and '906 patents, which dates back to at least U.S. Provisional Application 60/277,217 filed March 19, 2001, if not the invention date of November 28, 2000 or earlier as shown in the '217 Provisional.

99. However, Dr. Lebby alleges that Smith is prior art because it claims the benefit of the '683 provisional filed on September 22, 2000 and '285 provisional filed on February 7, 2001. Even if Smith is entitled to the filing date of the '683 provisional and '285 provisional, the subject matter Dr. Lebby relies on in Smith does not predate the '905/'906 patent invention date and is not supported by the '683 provisional or '285 provisional.

100. Dr. Lebby tacitly admits that Smith (and other references) are deficient for teaching various claim features, but then tries to bridge the gap with meritless conclusory statements. Lebby Report, ¶¶ 465, 467, 469, 495, 552, 560, 561, 565, 596, and 610, For example:

- Dr. Lebby concludes: "To the extent that "fiber collimator" port requires a collimator and a port in a single package, a POSITA would have known to combine a collimator and a port to make a "fiber collimator" port in a single package." Lebby Report, ¶¶ 465, 467, 469, and 495.
- Claim 69 of the '906 patent: "Further, to the extent Smith does not teach "maintaining a predetermined coupling of each reflected spectral channel into one of said fiber collimator output ports," this limitation would have been within the common knowledge of a POSITA and were taught by other prior art references discussed throughout this report." Lebby Report, ¶ 552.

- Claim 80 of the '906 patent: "To the extent Smith does not teach "wherein said beam-focuser comprises a focusing lens having first and second focal points [,]" these limitations would have been within the common knowledge of a POSITA and were taught by other prior art references discussed throughout this report." Lebby Report, ¶ 560.

101. Dr. Lebby fails to provide specific combinations. Throughout Dr. Lebby's report, he introduces a deficiency in the primary reference and fails to provide a specific reference that teaches the missing element. He does this for most claim elements and most claims. Lebby Report, ¶¶ 465, 467, 469, 495, 552, 560, 561, 565, 596, and 610, For example:

- Claim 69 of the '906 patent: "Further, to the extent Smith does not teach "maintaining a predetermined coupling of each reflected spectral channel into one of said fiber collimator output ports," this limitation would have been within the common knowledge of a POSITA and were taught by other prior art references discussed throughout this report." Lebby Report, ¶ 552.

102. Dr. Lebby provides several citations to Smith that he alleges disclosing "individually and continuously controllable in two dimensions." Lebby Report, ¶¶477-479. But nowhere do these citations mention beam-deflecting elements that are "individually and continuously controllable in two dimensions." And Dr. Lebby provides no analysis to show how the cited disclosures teach continuous individually and continuously controllable in two dimensions. Dr. Lebby provides nothing more than a mere conclusory statement, with no accompanying analysis, that the disclosure shows continuous control. Lebby Report, ¶¶476-480.

103. Dr. Lebby asserts obviousness using multiple combinations to Smith without any details to fill the gap. Dr. Lebby's Report does not point to any specific elements in other references to combine with Smith. The obviousness arguments are hindsight as Dr. Lebby uses the claims as a roadmap for his obviousness arguments and conclusions.

104. Dr. Lebby does not address obviousness of all the claims and claim limitations. The analysis is limited to "certain example limitations form the Asserted Claims."

105. Dr. Lebby ignores publically available information regarding invention date and constructive reduction to practice that should remove Smith as prior art.

3. Missing Elements in Smith

a. '905 Patent, [23-e]: "a spatial array of beam-deflecting elements positioned such that each element receives a corresponding one of said spectral channels, each of said elements being individually and continuously controllable in two dimensions to reflect its corresponding spectral channel to a selected one of said output port or the fiber collimator ports and to control the power of the spectral channel reflected to said output port or the fiber collimator selected port."

106. Smith does not disclose "beam-deflecting elements…being individually and continuously controllable in two dimensions."

107. Dr. Lebby claims that Smith discloses "individually and continuously controllable in two dimensions" by a gimbal structure in a two dimensional array of dual-axis tiltable mirrors in MEMS array 204 in Fig. 14 of Smith. *See* Lebby Report, ¶ 477. Figure 14 is reproduced below.

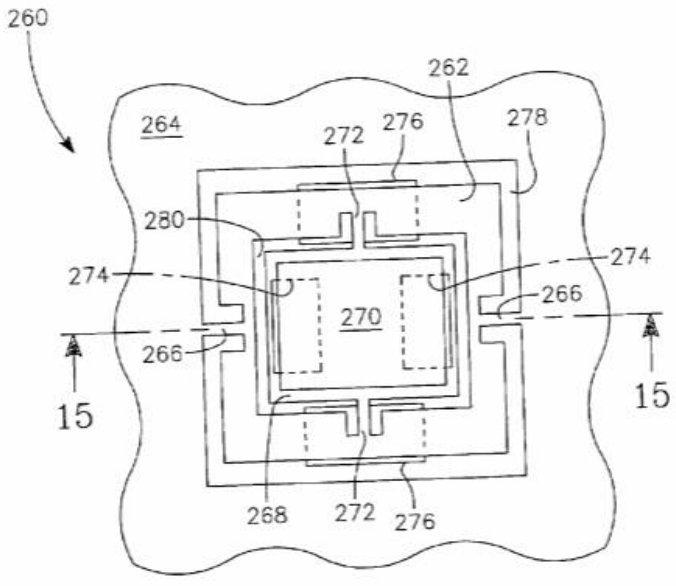


FIG. 14

Smith, Fig. 14.

108. Smith does not disclose the gimbal structure can be "individually and continuously controllable in two dimensions." And Dr. Lebby does not provide any analysis that the tiltable mirrors discloses "individually and continuously controllable in two dimensions."

109. This missing element applies to other independent claims 47, 49, 51, 68, 100, 107, 115, and 133 in '905 and '906 patents.

b. '905 Patent, [26]: "The optical add-drop apparatus of claim 25, wherein said servo-control assembly maintains said power levels at predetermined values."

110. Smith does not disclose a "servo-control assembly [that] maintains [] power levels at predetermined values."

111. Dr. Lebby claims that Smith discloses this claim element by pointing to "the controller…adjusts the mirror positions to adjust the transmitted power to conform to one or more ***predetermined criteria***." *See* Lebby Report, ¶¶ 485 and 486. But Dr. Lebby does not provide any analysis that "conform to one or more predetermined criteria" would maintain "said power levels at predetermined values." Actually, Smith adjusts the transmitted power "to maintain the power levels of different signals to be the same or at least in predetermined ratios." *See* Smith, 6:21-23.

c. '905 Patent, [29]: "The optical add-drop apparatus of claim 23 further comprising alignment mirrors for adjusting alignment of said input and output multi-wavelength optical signals and said second spectral channels with said wavelength-selective device."

112. Smith does not disclose "alignment mirrors for adjusting alignment of said input and output multi-wavelength optical signals and said second spectral channels with said wavelength-selective device."

113. Dr. Lebby claims that Smith discloses the alignment mirrors, and that these alleged alignment mirrors are various mirrors 192, 194, 196, 198, 200 and lens system 202 in Fig. 13 of Smith. *See* Lebby Report, ¶¶ 491-492. Figure 13 is reproduced below.

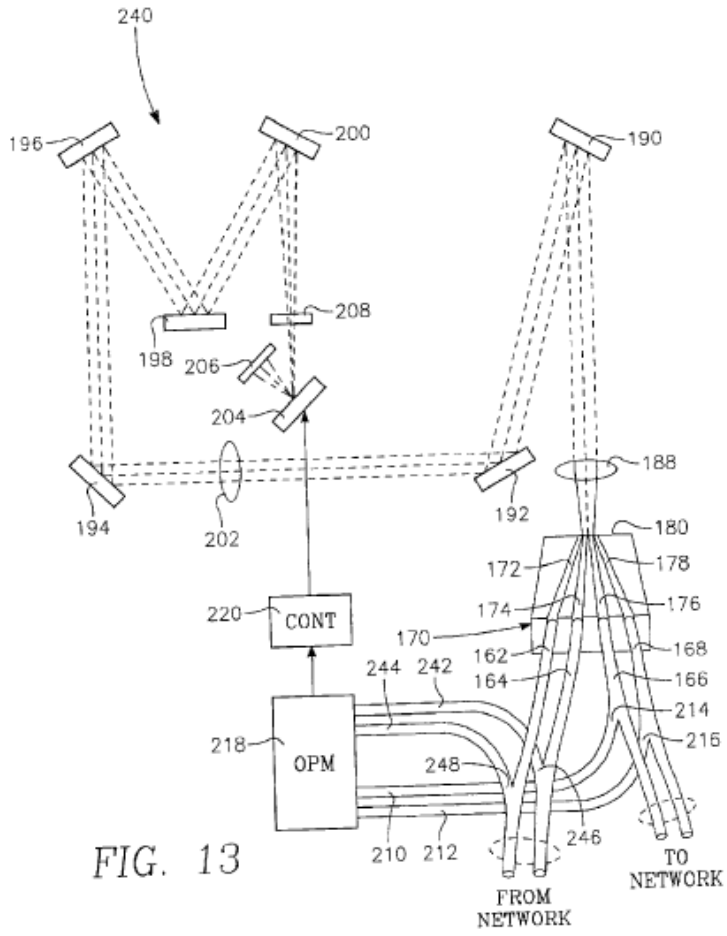


FIG. 13

Smith, FIG. 13

114. The mirrors 192, 194, 196, 198, 200 in Fig. 13 of Smith are not the claimed alignment mirrors. Because mirrors 192, 194, 196, 198, 200 "are included to condense the overall size of the system with little significant influence on the overall operation." And "lens system 202 focuses the beams on to a MEMS micromirror array 204." *See* Smith, 12:39-50. Dr. Lebby does not provide any analysis how these alleged alignment mirrors "adjust[] alignment of said input and output multi-wavelength optical signals and said second spectral channels with

said wavelength-selective device." Based on my review of Smith, Smith uses two MEMS arrays and a folding mirror for switching and alignment. In Smith, after the first normal reflection from MEMS array 204, light beam needs to travel to the fold mirror 206 and gets reflected back to MEMS array 204 for the secondary reflection. The light beam keeps broadening during the additional propagation thus causing an overflow on the neighboring MEMS tiles leading to a crosstalk and mix-up between channels. "A lens system 202 focuses the beams onto a MEMS mirror array 204, placing the gaussian waists of the beams at the mirror surfaces." Smith, 12:43-45. "A fold mirror 206 optically couples the respective input and output mirrors. … the micromirror array 204 and the fold mirror 206 are separated by a distance that is equal to the Rayleigh range of the input beams." Smith, 12:50-51. "This condition minimizes the ratio of spot size to beam separation at the micromirror plane, minimizes the cross talk between beams, and reduces losses due to leakage around the mirror edges." Smith, 12:58-61. Smith is trying to "minimize" this effect acknowledging such detrimental crosstalk effect in its design but cannot remove it completely because of the optical layout specifics requiring additional travel and reflections from the fold mirror and a secondary one from the MEMS.

d. '905 Patent, [45]: "The optical add-drop apparatus of claim 44, wherein the power-management system is further configured to control coupling efficiency of one of the first and second spectral channel to at least one port."

115. Smith does not disclose "wherein the power-management system is further configured to control coupling efficiency of one of the first and second spectral channel to at least one port."

116. Dr. Lebby claims that Smith discloses the power-management system. The alleged power-management system in Smith includes the optical power monitor 156 and control 158 in Fig. 12. *See* Lebby Report, ¶¶ 509-511. Figure 12 is reproduced below.

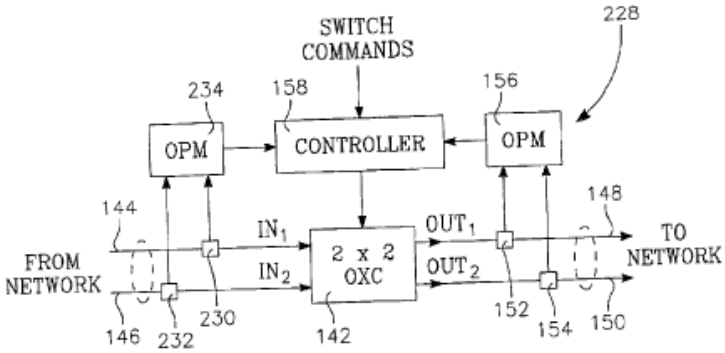


FIG. 12

Smith, FIG. 12

117. Smith recites "the optical power monitor 156 preferably ***measures the power*** on each of the WDM channels, and the controller 158 accordingly ***adjusts the power transmission*** for that wavelength channel through the cross connect 142." *See* Smith, 9:20-33. Dr. Lebby does not provide any analysis that adjusting the power transmission would control coupling efficiency of the first and second spectral channel to at least one port. Actually, Smith adjusts the power transmission "to maintain the power levels of different signals to be the same or at least in predetermined ratios." *See* Smith, 6:21-23.

4. The proposed obviousness combinations using Smith are flawed

118. Dr. Lebby, in his expert report, indicates several limitations of Smith that are purportedly disclosed by combining Smith with other references. Dr. Lebby does not address all the claims and claim limitations of Smith. His analysis is limited to "certain example limitations form the Asserted Claims." Lebby Report, ¶1864.

119. In addition, Dr. Lebby asserts obviousness using multiple combinations to Smith without any details to fill the gap. Dr. Lebby does not point to any specific elements in other references to combine with Smith.

5. Dr. Lebby admits that Smith is missing at least the following features:

120. Maintaining a predetermined coupling in '906 patent claims 69, 89-c, 116 and 134. Lebby Report, ¶¶ 1865-1868.

121. A beam focuser having first and second focal points in '906 patent claims 81, 82, and 123. Lebby Report, ¶¶ 1869-1872.

122. Quarter-wave plate in '906 patent claims 85 and 125. Lebby Report, ¶¶ 1873-1876. (See Lebby Report, ¶¶1864-1876.)

123. It is not obvious to combine Smith with other references for these features. For example:

a. '906 Patent [69], [89-e], 116, 134: "…maintaining a predetermined coupling of each reflected spectral channel into one of said output ports."

124. Dr. Lebby states that it would have been obvious to a POSA to combine Smith with Sparks, Rose, Lalonde, Bouevitch, Tew '070 and/or Carr to obtain the claimed "maintaining a predetermined coupling." Lebby Report, ¶¶1865-1868.

125. Dr. Lebby does not point to any specific elements of Sparks, Rose, Lalonde, Bouevitch, Tew '070 and/or Carr to teach "maintaining a predetermined coupling." Lebby Report, ¶1865-1868.

126. Smith recites "all wavelength channels on output fiber should have ***the same intensity*** so that optical receivers and other components located downstream will detect wavelength channels of ***equal intensity***," and "measures are needed to maintain the power levels of different signals to be the same or at least in predetermined ratios." Smith, 6:21-23 and 9:59-64.

127. A POSA would not be motivated to combine Sparks, Rose, Lalonde, Bouevitch, Tew '070 and/or Carr to "maintain[] a ***predetermined coupling of each reflected spectral channel*** into one of said output ports." Nor does Dr. Lebby, in his expert report indicate how

combine Smith with Sparks, Rose, Lalonde, Bouevitch, Tew '070 and/or Carr to perform such functions.

b. '906 Patent [81], [82], [123]: "…said wavelength-separator and said channel micromirrors are placed respectively at said first and second focal points of said focusing lens."

128. Dr. Lebby states that it would have been obvious to a POSA to combine Smith with Tew '640 and/or Rose to obtain the claimed "said wavelength-separator and said channel micromirrors are placed respectively at said first and second focal points of said focusing lens." Lebby Report, ¶¶1869-1872.

129. Dr. Lebby alleges Tew '640 and/or Rose discloses an optic "focusing light onto multiple focal points." But Dr. Lebby does not point to any specific elements of Tew '640 and/or Rose to teach "said wavelength-separator and said channel micromirrors are placed respectively at said first and second focal points of said focusing lens." Lebby Report, ¶¶1869-1872.

130. Smith recites "lens system 202 focuses the beams on to a MEMS micromirror array 204." *See* Smith, 12:39-50. A POSA would not be motivated to combine Tew '640 and/or Rose such that "said wavelength-separator and said channel micromirrors are placed respectively at said first and second focal points of said focusing lens." Nor does Dr. Lebby, in his expert report indicate how to combine Smith with Tew '640 and/or Rose to realize such configurations.

B. U.S. Patent No. 6,097,859 ("Solgaard")

131. Dr. Lebby's obviousness analysis with respect to Solgaard is deficient in many respects. Dr. Lebby provides no analysis to show how Solgaard in combination with other references teaches the claimed limitations of the '905 and '906 patents. Dr. Lebby throughout his report provides nothing more than a mere conclusory statement, with no accompanying analysis, and often reverts to blanket statements that it would have been obvious to a POSA to combine

F. U.S. Patent No. 6,498,872 ("Bouevitch")

1. Overview of Bouevitch

253. Bouevitch describes an optical device for rerouting and modifying an optical signal, including modifying means such as a MEMS array and a liquid crystal array which function as an attenuator when the device operates as a dynamic gain equalizer (DGE), and as a switching array when the device operates as a configurable optical add/drop multiplexer (COADM). Bouevitch, Abstract.

254. Bouevitch was used by the Examiner in a rejection during the '905 patent prosecution that was overcome and cited in both the '905 and '906 patent prosecutions in an Information Disclosure Statement (IDS) during the prosecution, which was considered by the Examiner on June 6, 2019. *See* CAP_0004794 and CAP_0014483. Bouevitch was substantively considered and explicitly overcome during the prosecution of parent applications. *See* CAP_0010912-CAP_0010919 and CAP_0014806-CAP_0014813.

255. The File Histories of each from thirteen IPRs (IPR2014-01166, IPR2014-01276, IPR2015-00726, IPR2015-00727, IPR2015-00731, IPR2015-00739, IPR2015-00816, IPR2015-00894, IPR2015-01958, IPR2015-01961, IPR2015-01969, and IPR2015-01971)—all applying Bouevitch—were included in an IDS during prosecution and signed by the Examiner on June 6, 2019. CAP_0004794 and CAP_0014483. Thus, the Examiner reviewed Defendant's arguments with respect to Bouevitch and explicitly found the claim patentable over Bouevitch.

256. Bouevitch appears on the cover of the '905 and '906 patents.

2. Global Arguments for all claims

257. Dr. Lebby tacitly admits that Bouevitch (and other references) are deficient for teaching various claim features, but then tries to bridge the gap with meritless conclusory statements. For example Dr. Lebby concludes: "[t]o the extent Bouevitch does not teach "fiber

collimator[,]" these limitations would have been within the common knowledge of a POSITA and were taught by other prior art references discussed throughout this report." Lebby Report [1311]; *see also* [1312] ("To the extent Bouevitch does not teach 'fiber collimator[,]' these limitations would have been within the common knowledge of a POSITA and were taught by other prior art references discussed throughout this report."); Lebby Report [1327] ("To the extent Bouevitch does not teach 'a control unit for controlling each of said beam-deflecting elements[,]' these limitations would have been within the common knowledge of a POSITA and were taught by other prior art references discussed throughout this report."). This is another example of how Dr. Lebby uses the recited claims as a roadmap for his arguments, which is impermissible hindsight.

3. Missing Elements in Bouevitch

a. Bouevitch does not teach or suggest the recited ports.

i. '905 Patent, [23-a] "fiber collimator input port," [23-b] "fiber collimator one or more other ports," [23-c] "output port," [47-a] "fiber collimator serving as an input port," [47-b] "an output port," [47-c] "one or more fiber collimators serving as one or more drop ports," [49-a] "a fiber collimator serving as an input port,"[49-b] "an output port," [49-c] "one or more fiber collimators serving as one or more add ports," [51-d] "an output port," and [51-f] "one or more fiber collimators serving as drop ports," and

'906 Patent [68-a] "multiple fiber collimators, providing and serving as an input port…and a plurality of output ports," [89-a] "an input port…and a plurality of output ports; [100-a] "an array of fiber collimators providing and serving as an input port," [100-b] "a plurality of output ports," [115-a] "an array of fiber collimators, providing and serving as an input port," [115-b] "a plurality of output ports including a pass-through port and one or more drop ports," [133-a] "a fiber collimator input port," [133-d] "output ports"

258. The claims require at least three different fiber collimator ports, including variations of: "an input port;" (ii) "one or more other ports;" (iii) "output port(s);" (iv) "pass-through ports;" (v) "drop ports," etc. Each of these ports is configured to carry a distinct set of spectral channels. Unlike these claims, Bouevitch's system has only two collimator ports—which falls short of the claimed ports.

259. It appears that Dr. Lebby attempts to map the Bouevitch's circulator ports to the claimed ports. *See* e.g. Lebby Report, 1316. A POSA would have understood that this is incorrect. First, the '905 and '906 patents teach away from the use of circulators. That is, the patents describe conventional OADMs as prior art. *See* '905 patent 1:58-3:62; *see also* '906 patent 1:61-3:67. Many of these OADMs required optical circulators to perform add/drop functions, and according to the inventors of the '905 and '906 patents, optical circulators were disadvantageous. *See* '905 patent 2:59-61 ("An optical circulator therefore has to be implemented, to provide necessary routing."), 3:2-5 ("[O]ptical circulators implemented in [prior art configurations] for various routing purposes introduce additional optical losses, which can accumulate to a substantial amount."); *see also* '906 patent 2:62-64, 3:5-8. Circulators are contrary to the basis of the '905 and '906 patent's technology—to provide an optical switch that is reconfigurable and scalable to a large number of channels. Thus, Bouevitch's circulators do not teach or suggest the claimed ports.

260. Furthermore, it would be wrong to argue that the circulator ports teach or suggest these features because the circulators 80a and 80b are far removed from Bouevitch's free-space optics. Taking the '906 patent's independent claim 68 as illustrative of this principle, claim 68 recites "said channel micromirrors being pivotal about two axes and being individually and continuously controllable to reflect corresponding received spectral channels into any selected ones of said fiber collimator output ports and to control the power of said received spectral

channels coupled into said fiber collimator output ports." Since circulators are far removed from Bouevitch's free-space optics, this interpretation makes no sense. In Bouevitch, a light beam is reflected back to lens 90/990 and then passes through either waveguide 99a or 99b. (*See* Bouevitch, 14:55-15:18.) After the light beam passes through waveguide 99a or 99b, the beam then propagates to the circulator port 3 of circulator 80a or 80b. (*See id.* at 14:55-15:18.) Propagating through a circulator is not reflecting as recited in the '678 patent. This is because an output light beam has already entered an optical fiber (i.e., exited free-space optics) by the time it reaches circulator port 3 of circulator 80a or 80b.

261. A POSA would have understood that the claimed multi-port configuration was Capella's differentiating factor in the market. *See* Holliday ROADMs, CAP_0002693 ("Capella [was] the only company to offer a [multi] port solution, i.e., one input, one express output, and [multiple] service ports [that] may be configured as either drop or add [ports] depending on the application" whereas "traditional [systems had] single input, single output wavelength blocker architectures which require[d] a number of peripheral components and interconnections, driving up cost and complexity.").) The '905 and '906 patents intended to cover this differentiating factor. *See* WavePath, CAP_0002694-CAP_0002697. Thus, Bouevitch's circulators do not teach or suggest the claimed ports.

262. Carr, Sparks, and Smith fail to cure the foregoing deficiencies because, unlike the claimed ports, Carr's, Sparks's, and Smith's ports are not collimator ports configured to carry distinct sets of spectral channels. Instead, Carr, Sparks, and Smith disclose output ports that carry the exact same signal as the input port. So, none of these references teaches or suggests the claimed ports.

b. Bouevitch does not teach or suggest the recited beam deflecting elements:

i. '905 Patent [23-e], [47-e], and [49-e] "a spatial array of beam-deflecting elements," [51-b] "a corresponding beam-deflecting element"

'906 Patent [133-c] "a spatial array of corresponding beam-deflecting elements"

263. It is undisputed that Bouevitch fails to teach or suggest the claimed "beam deflecting elements" that are "continuously controllable in two dimensions." Specifically, Bouevitch's MEMS mirrors tilt along only one axis and its mirrors switch between only two states. A POSA would have never used two-axis mirrors in Bouevitch's system to control power through intentional misalignment, because doing so would destroy Bouevitch's principle of operation.

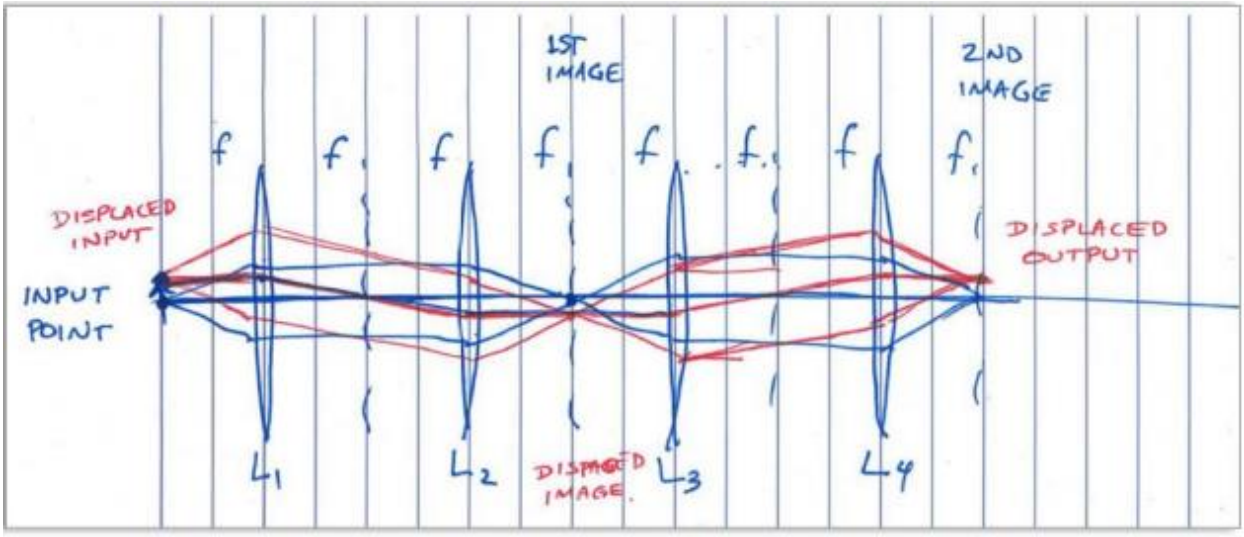
4. The proposed obviousness combinations using Bouevitch are flawed

a. Introducing misalignment or angular displacement would alter the intended function of Bouevitch's system

264. As an initial matter, Bouevitch's system is designed as a symmetrical 4-f system that automatically corrects for any unintentional misalignment. Bouevitch describes this 4-f design as an "advantage" over the prior art. This advantage would be lost, however, if Bouevitch was combined with other references that control power through intentional misalignment, like Smith, Carr, and Sparks for example. So, a POSA would not have combined Bouevitch with Smith, Carr, Sparks, and any other similar reference.

265. In addition to destroying Bouevitch's principle of operation, a POSA would have had no reason—absent hindsight—to use references having two-axis mirrors in Bouevitch's system.

266. Bouevitch designed a symmetrical "4-f optical system" that automatically avoids misalignment or angular displacement. *See* Bouevitch, Abstract, 2:37-43, 10:62-11:4. This 4-f design "advantageously" has "fewer alignment problems and less loss than prior art systems." Bouevitch, 10:62- 65; *see also id*. at Abstract. Fujitsu's expert in IPR2015-00726, Dr. Ford, explained how such an auto-aligning 4-f optical system works. Ford Depo. Tr., CAP_0002550-56, CAP_0002579 . His explanation relies on the hand-drawn figure reproduced below. Dr. Ford described this figure as illustrating an "unfolded" 4-f optical system. Ford Depo. Tr., CAP_0002551.



267. In this system, the lenses are labeled L1, L2, L3, and L4, and the spacings are each labeled f. Dr. Ford drew an undisplaced input signal in blue ink and a displaced input signal in red ink. *See id*. at CAP_0002552-54. According to Fujitsu's expert, "[the] input point . . . emits light which is collimated by the first lens, propagates to the second lens, [and then is] focused by the second lens to a point . . . ." *Id*. at CAP_0002552. This point is on the first image plane. See *id*. at CAP_0002552-53. As the light beam takes a second pass through the 4-f system, a second image forms on the second image plane. The advantage of this 4-f system is that it

autocorrects for any (unintentional) misalignment. *See* Ford Depo. Tr., CAP_0002544-45. For example, if the fiber input is vertically displaced upward, as shown in red ink in the figure above, the first image is laterally displaced downward along the first image plane. *Id*. at CAP_0002553-55.

268. Bouevitch discloses: a folded 4-f system that autocorrects for any unintentional misalignments. *See* Bouevitch, Abstract, 10:62-11:4. Bouevitch characterized this 4-f optical design as an "advantage" over prior-art systems. *See* Bouevitch, 10:65-11:1; *see also id*. at Abstract, 1:51-57, 2:37-43, 10:62-11:4, 11:50-58. For example, Bouevitch states that "[o]ne significant advantage relates to the fact that the angle of incidence on the grating, in the first and second pass, is inherently matched with the optical arrangement." *Id*. at 11:1-4. In other words, the advantage of Bouevitch's symmetrical 4-f system is that it automatically corrects for any unintentional misalignments.

269. This advantage would be lost, however, if either Carr, Sparks, Smith, or a similar reference were combined with Bouevitch, because both the references control power through intentional misalignment. For example, Carr's FIG. 9 (reproduced at right) shows how intentional misalignment can be used to attenuate the power of an optical output signal. Referring to this figure, Carr explains that the reflected signal 93 can be attenuated.

270. To the extent Dr. Lebby argues that Bouevitch's alleged attenuation by "modifying means 950," I disagree. Bouevitch's attenuation occurs by polarization and cannot be accomplished through misalignment.

271. Bouevitch's Figure 9 (reproduced below) includes, among other things, a modifying means 950 capable of provided variable attenuation. But any attenuation achieved by Bouevitch is obtained through polarization, not misalignment. Bouevitch, 7:37-41 ("After passing through the quarter waveplate 157, the beam of light becomes circularly polarized and is

incident on a predetermined reflector of the MEMS array 155…The degree of attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)…the attenuated sub-beam of light will have a polarization state that has been rotated 90° from the original polarization state."); 7:45-49; and 11:28-40. Each of the elements of Figure 9 are fixed and do not move or pivot and are not controllable.

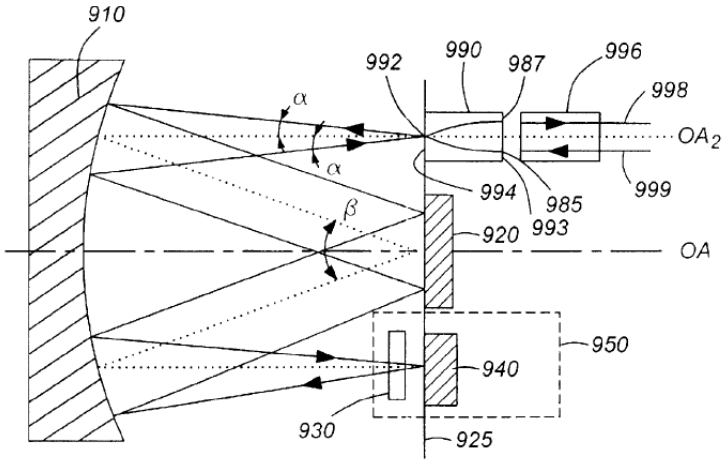


FIG. 9

272. Any alleged attenuation that may occur through Bouevitch's modifying means 950 does not make it combinable with references that use multiple mirrors to misalign a beam, such as Carr, Sparks, and Smith. A POSA would have understood that two operations are vastly different and not combinable.

b. Bouevitch teaches away from misalignment or angular displacement

273. Bouevitch teaches that "angular displacement is disadvantageous with respect to coupling the add/drop and/or input/output beams of light into parallel optical waveguides . . . ." Bouevitch, 2:1-7; 10:62-11:4 ("Advantageously, the optical arrangement shown in FIGS. 6a and 6b provides a symmetrical 4-f optical system with fewer alignment problems and less optical loss than prior art systems."). Bouevitch teaches that angular displacement is disadvantageous with

respect to coupling the add/drop and/or input/output beams into an optical waveguide, so Bouevitch designs its system so "lateral displacement of the input and modified output beams of light (i.e., as opposed to angular displacement) allows for highly efficient coupling between a plurality of input/output waveguides." *Id.* at 7:50-65.

274. To avoid angular displacement or misalignment to the output port, Bouevitch has a "single collimating/focusing lens 990 [that] provides the input beam of light and receives the modified output beam of light . . . ." Bouevitch, 14:3- 13.) Using this GRIN lens 990, "the angular displacement provided by each MEMS reflector complements the angular displacement resulting from the use of the off-axis input/output port(s) on the GRIN lens 990." *Id.* at 14:3-13.

275. In instances where the angular displacement provided by a MEMS reflector does not complement the angular displacement of the input light beam, Bouevitch purposely moves its optical waveguides to complement any angular displacement. *See id.* at 15:19-30, FIG. 12. So again, Bouevitch goes out of his way to efficiently couple the add/drop and input/output beams of light into parallel optical waveguides.

276. In all instances, Bouevitch efficiently couples the add/drop and input/output beams of light into parallel optical waveguides. This is what Bouevitch calls the spirit and scope of [his alleged] invention." Bouevitch at 15:19- 30.

277. In view of the foregoing, a POSA would understand that Bouevitch discourages misalignment.

5. Dr. Lebby admits that Bouevitch is missing claim features

278. Dr. Lebby alleges the following features are missing: (See Lebby Report, [1961]-[1993])

279. A control unit/servo-control assembly ('905 claims 24, 25, 26 and '906 claims 69, 70, 90, 116, 117, 134).

280. Alignment mirrors (’906 claims 29, 72, 92, 100, 118)

281. Transmitting signals through a circulator (”905 claims 37, 48, 50, and ’906 claims 88, 99, 106, 132)

282. Fiber collimators (’905 claim 39 and ’906 claims 68, 89, 100, 115, 126, 131, 133).

283. Pivoting about two axes (’906 claims 68, 115, 133).

284. Silicon micromirros (’906 claims 79, 96, 122, 129, 139)

285. Optical sensors (’906 claims 86, 87)

286. Auxiliary components (’906 claims 126, 129).

G. U.S. Patent No. 6,625,340 (“Sparks”)

1. Overview of Sparks

287. Sparks describes an optical switch arranged to misalign the optical beam path to provide a predetermined optical output power. Sparks, Abstract. According to Sparks, “[t]he system operates by controlling the movable micromirrors (16,26), which are fabricated using MEMS technology and are capable of two axis movement, to carefully align the beams so as to ensure that the maximum possible input optical signal is received at the output of the switch.” *Id.* at 4:43–46.

288. Sparks is a simple broadband optical switch, with no ability to multiplex or demultiplex spectral channels. Specifically Sparks relates to “controlling an optical switch for attenuation of an optical signal.” Sparks, 1:6-7. Sparks’ optical switch “is constructed of a number of modules or units.” *Id.*, 4:15-16. Figure 1 (reproduced below) shows a first module 10 and a second module 20. *Id.*, 4:15-17. Each module includes a fixed mirror (such as, mirror 14 of module 10 and mirror 24 of module 20) and a moveable mirror (such as, mirror 16 of module 10 and mirror 26 of module 20). *Id.*, 4:18-31.

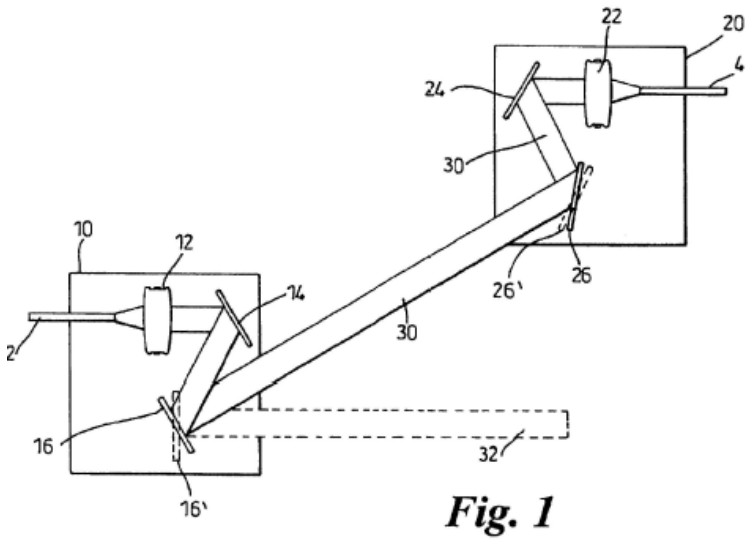


Fig. 1

289. Sparks appears on the cover of the '905 and '906 patents. Sparks was cited in an IDS during the prosecution and then considered and signed by the Examiner on June 6, 2019. CAP_0004794 and CAP_0014483.

290. The File Histories of several IPRs (IPR2015-00726, IPR2015-00727, IPR2015-00731, IPR2015-00739, IPR2015-01958, IPR2015-01961, IPR2015-01969, and IPR2015-01971) citing Sparks against similar claims, were included in an IDS during prosecution and signed by the Examiner on June 6, 2019. CAP_0010912-CAP_0010919 and CAP_0014806-CAP_0014813. Thus, the Examiner reviewed Defendant's arguments with respect to Sparks and found the claim patentable over Sparks.

2. Sparks does not teach or suggest the recited ports.

a. '905 Patent, [23-a] "fiber collimator input port," [23-b] "fiber collimator one or more other ports," [23-c] "output port," [47-a] "fiber collimator serving as an input port," [47-b] "an output port," [47-c] "one or more fiber collimators serving as one or more drop ports," [49-a] "a fiber collimator serving as an input port,"[49-b] "an output port," [49-c] "one or more fiber collimators serving as one or more add ports," [51-d] "an output port," and [51-f] "one or more fiber collimators serving as drop ports," and

'906 Patent [68-a] "multiple fiber collimators, providing and serving as an input port…and a plurality of output ports," [89-a] "an input port…and a plurality of output ports; [100-a] "an array of fiber collimators providing and serving as an input port," [100-b] "a plurality of output ports," [115-a] "an array of fiber collimators, providing and serving as an input port," [115-b] "a plurality of output ports including a pass-through port and one or more drop ports," [133-a] "a fiber collimator input port," [133-d] "output ports"

291. At the outset, it appears that Dr. Lebby admits that Sparks does not teach or suggest the claimed ports. *See* Lebby Report, 1932.

292. Sparks is a simple broadband optical switch, with no ability to multiplex or demultiplex spectral channels. Specifically Sparks relates to "controlling an optical switch for attenuation of an optical signal." Sparks, 1:6-7. Sparks' optical switch "is constructed of a number of modules or units." *Id.*, 4:15-16.

293. Sparks's ports are not configured to carry distinct sets of spectral channels. Instead, Sparks discloses output ports that carry the exact same signal as the input port. Sparks incorporates power control into an optical cross-connect ("OXC"). *See* Sparks, 3:54-56. This OXC is shown in Sparks's Figure 1 (reproduced below).

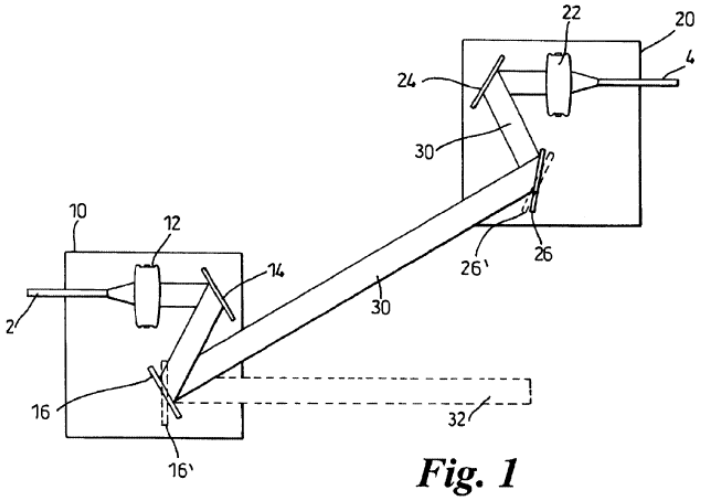


Fig. 1

294. This OXC switches light between two modules 10 and 20. Sparks at 4:16-17. Each OXC module comprises a fiber (2, 4), a lens (12, 22), a fixed mirror (14, 24), and a movable micromirror (16, 26). Sparks, 4:16-23. When making an optical connection between modules, the movable mirror of the source module directs the beam to the movable mirror of the target module. *See id.* at 4:24-26. At the same time, the movable mirror of the target module is controlled to deflect the beam toward the fixed mirror and into the lens, completing the connection to the target module's fiber. *See id.* at 4:26-32.

295. A POSA would have understood that a broadband cross connect, like that of Sparks, does not break up a multi-wavelength input signal into its constituent spectral channels. The signal that enters the optical cross connect is simply switched to an output. A multi-wavelength optical signal input into an optical cross connect is not demultiplexed within the switch.

296. Thus, Sparks, being an optical cross connect, does not disclose a plurality of output ports for received spectral channels, as recited in the '905 and '906 patents.

3. The proposed obviousness combinations using Sparks are flawed

297. As I explained above, a POSA would not be motivated to combine Sparks with Bouevitch.

298. It is also my opinion, that a POSA would not be motivated to combine Tew '640 with Sparks, nor by doing so would obtain the claimed "servo-control assembly" that maintains said power levels at a predetermined value" and "predetermined coupling."

299. Dr. Lebby points to Spark's disclosure of "a closed-loop servo control system" and states that it would have been obvious for a POSA to incorporate that system into the circuitry of Tew '640 to obtain the claimed "servo-control assembly" used to "maintain[] said power levels at predetermined values" and "predetermined coupling." Lebby Report, ¶1835.

300. As discussed below, it is my opinion that Tew '640 does not disclose any servo-control assembly. It is also my opinion that a POSA would not be motivated to combine the disclosed circuitry in Tew '640, which is used for image processing and to control the mirrors based on the same, with any elements in Sparks such that the claimed "servo-control assembly [that] maintains said power levels at predetermined values" and maintain "predetermined coupling."

301. As discussed below, Tew '640's circuit is meant "to control the transfer of the digital image data to the underlying memory cells." Tew '640, 5:57-6-4. Nothing in Tew '640 or Sparks indicate how image processing circuitry used to transfer digital image data to underlying memory cells can be combined with the "closed-loop servo control system" of Sparks to "maintain [] power level" of spectral channels "at predetermined values" or maintain "predetermined coupling." Nor does Dr. Lebby, in his Expert Report indicate how the image processing circuits of Tew '640 in combination with Sparks can be modified to perform such functions.

4. Dr. Lebby admits that Sparks is missing many claim features

302. Dr. Lebby admits the following features are missing from Sparks. See Lebby[1931]-[1960].

303. A one-dimensional array of ports ('905 claim 39).

304. Silicon micromirror ('906 claims 79, 96, 122, 129, 139).

305. A beam focuser having first and second focal points ('906 claims 81, 82, 123)

306. An assembly of lenses ('906 claims 83, 98).

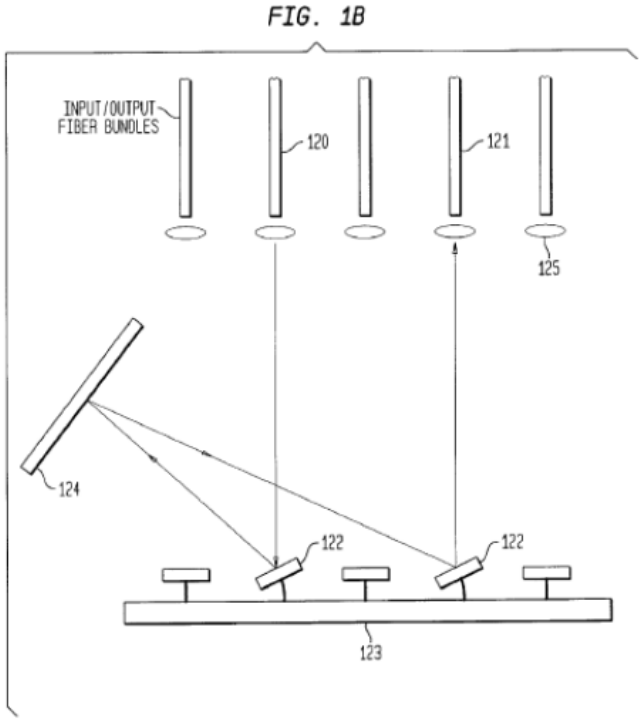
307. Quarter-wave plates ('906 claims 85, 125).

308. A pass-through port ('906 claims 115, 126, 131, and 133).

H. U.S. Patent No. 6,442,307 ("Carr")

1. Overview of Carr

309. Carr describes a MEMS mirror device comprised of a mirror movably coupled to a frame and an actuator for moving the mirror. Carr, Abstract.

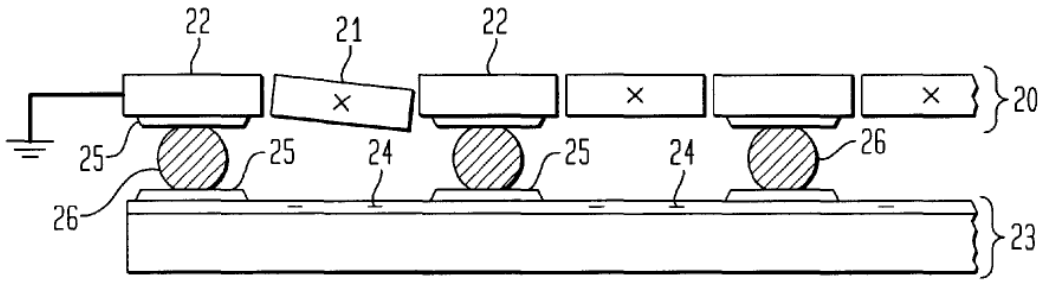


310. The File Histories of four IPRs (IPR2015-00726, IPR2015-00727, IPR2015-01958, and IPR2015-01961) citing Sparks, were included in an IDS during prosecution and then considered and signed off on by the Examiner on June 6, 2019. CAP_0004794 and CAP_0014483.

2. Missing Elements: Carr does not teach or suggest "maintaining a predetermined coupling of each reflected spectral channel into one of said fiber collimator output ports by adjusting micromirrors."

311. Dr. Lebby's alleges that Carr teaches "maintaining a predetermined coupling of each reflected spectral channel into one of said fiber collimator output ports by adjusting micromirrors. Lebby [1810]. However, Carr does not teach or suggest maintaining a "spectral channel."

312. I note that Carr is simply a broadband optical switch, with no ability to multiplex or demultiplex spectral channels. Specifically, Carr is directed to an array of movable MEMS mirrors. Carr, Title, Abstract. For example, Figure 2A (reproduced below) shows a gimbaled mirror 21 movably coupled to its surrounding frame 22. Layer 23 includes actuating electrodes 24 that tilt mirror 21 via electrostatic actuation. Carr, 3:33-39; 49-51.



Carr, FIG 2A.

313. Thus, Carr, like Sparks above, is a broadband optical cross connect. A POSA would have understood that a broadband cross connect does not break up a multi-wavelenght input signal into its constituent spectral channels. Instead, the signal that enters Carr's optical cross connect system is simply switched at an output and does not carry distinct sets of spectral channels.

314. A multi-wavelength optical signal input into an optical cross connect is not demultiplexed within the switch. So Carr does not disclose maintaining spectral channel.

574. Based on reviewing Dr. Lebby's expert report, it is my understanding that Yuan is used only for purportedly disclosing "fiber collimators" and not used to disclose any other elements of the '905 patent. Lebby Report, ¶¶1825-1829. With respect to the obviousness combinations that Dr. Lebby relies on Yuan, I have addressed the deficiencies of Yuan with respect to those combinations. For the reasons stated in those sections, it is my opinion that Yuan cannot be combined with any other references to render obvious the claims of the '905 and '906 patents.

2. Missing Elements

575. Yuan does not disclose many of the claimed elements in the '905 and '906 patents. As previously indicated, Yuan is only used by Dr. Lebby for its purported disclosure of "fiber collimators" and not used to disclose any other elements of the '905 and '906 patents. Thus, in my opinion, Dr. Lebby recognizes that Yuan does not disclose any other elements of the '905 and '906 patents.

X. Conclusions

576. After carefully examining each of Dr. Lebby's theories of obviousness for the challenged claims, I conclude that none of them invalidated any of the asserted claims. Most of Dr. Lebby's opinions are fundamentally flawed in some way, either by considering references that are not prior art, failing to explain how references would be combined or even which aspects of different references would be combined, or failing to account for each and every limitation of the asserted claims even with the prior-art combinations he uses. Even for the few prior-art combinations that are not fundamentally flawed, Dr. Libby still errs in his technical analysis of why or how these references could be combined or the results of that combination. In my expert opinion, all of the asserted claims of the '905 and '906 patents are novel and nonobviousness.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Executed on this 5th day of April, 2021. By: Alex. Sergienko

Alexander V. Sergienko